Losses on the Great Lakes.—The storm of November 11, 1940, was one of the most severe of record affecting the Upper Great Lakes.

Lake Michigan.—Greatest losses were on Lake Michigan, which felt the full fury of the southwest gales. Three steamers were sunk, a number of others were grounded, and several smaller boats were lost. Possibly because early in the day the wind was from the southeast and increasing, some of the captains navigated their vessels near the east shore of Lake Michigan; the sudden shift to southwest gales later proved disastrous, as the steamers were practically helpless because they could not run before the storm nor withstand the battering which would result from heading into the gale and high waves. The three freighters that foundered all sank off Pentwater, near Ludington, Mich., with loss of life as follows: *William B. Davock*, 33; *Anna C. Minch*, 24; *Novadoc*, 2.

Other drownings occurred when the fishing tugs *Indian* and *Richard H.* and the motor cruiser *Nancy Jane*, with a total of 10 persons aboard, were lost on the southern end of Lake Michigan.

Ships reported as driven ashore or on reefs, in addition to many smaller boats, were: *Sinaloa* at Escanaba; *City of Flint* at Ludington; *Conneaut* on north shore of Straits of Mackinac; *Frank J. Peterson* on St. Helena Island (reported as abandoned on November 21).

Other vessels, including the *Joseph Block* and the *New Haven Socony*, were badly battered but eventually made port.

The effect of the sustained southwest gale on the water level of Lake Michigan is indicated by reports of a drop of 4.8 feet at Chicago, and a rise of 4 to 4.5 feet at Beaver Island. A lowering of water in the Fox River by about 5 feet, the result of south and southwest winds, forced paper mills and a power plant to suspend operations at Green Bay, Wisconsin.

Lake Superior.—On Lake Superior comparatively little damage occurred, and no loss of life was reported though two fishermen may have perished in Whitefish Bay. The shifting gales on the extreme western end of the lake were responsible for the breaking loose and the plunging overboard of a number of automobiles from the deck of the steamer *Crescent City*. Captain Harold B. McCool, master of the vessel, reported that the gale was the worst he had experienced on the Great Lakes in more than 40 years service, and is quoted as saying "In my opinion, the storm was even more severe than the disastrous storm during the Fall of 1913" (November 1913). The freighter *Sparta* was lost after grounding on rocks 5 miles east of Munising on the night of November 12, but no loss of life occurred.

Lake Huron.—Lake Huron traffic sustained losses small in comparison to those that might have resulted if the severe gales had been on-shore instead of off-shore. Damage was mostly to small craft, and no faltalities were reported. Fishing boats made shelter but losses to nets were considerable.

The Alpena Weather Bureau office supplied the following graphic account by the master of the steamer *Wyandotte:*

> The *Wyandotte*, a large freighter carrying 2,700 tons of coal and bound for Alpena, was off Saginaw Bay at the height of the storm. The sea broke over her decks in solid sheets. The storm was of such fury that water actually poured into her smoke stack at times. Normally an 11-mile-an-hour vessel, the freighter in some places could make no better headway than 2–3 miles an hour.

The lake level dropped about 2 feet at Alpena; and at Saginaw Bay the water receded a mile in places, lowering the water in the Saginaw River as much as 8 feet at its mouth, and 9 feet 15 miles upstream at the Consumers Power plant which had to be shut down. At Bay City the receding water caused water supply intake pipes to be exposed, thus necessitating the pumping of water from reservoirs.

Lower lakes.—Lakes Erie and Ontario, though lashed by gales, were far enough from the storm center to escape with only minor damage to shipping. The water level in the lower Detroit River was lowered about 4.5 feet by the strong winds on Lake Erie.

Though the loss of life on the Great Lakes in this storm was much smaller than in the case of the November 1913 disaster, nevertheless, the November 11, 1940, storm must be considered as one of the most devastating ever to sweep the Upper Great Lakes Region.

CONCLUSION

It has been pointed out that the storm described herein resulted in much loss of life and property because of its occurrence on a holiday immediately following the usual week-end vacation period. This is true, unfortunately, since the storm caught many hunters away from home and adequate shelter; and many automobiles were marooned on the highways in some sections. Apart from these and other circumstances that contributed to the appalling losses sustained, it remains a fact that the Armistice Day storm of 1940 was one of the very worst, considering the intensity of the meteorological factors and the effects thereof, ever to sweep over this vast area of the Midwest section of the United States.

NOTES AND REVIEWS

Andrew M. Hamrick and Howard H. Martin. *Fifty Years' Weather in Kansas City, Mo., 1889–1938.* MONTHLY WEATHER REVIEW SUPPLEMENT No. 44, 1941. 53 pp.

This publication is devoted to detailed climatic statistics compiled from the records of the Weather Bureau station at Kansas City. The data are presented in 34 graphs accompanied by a brief descriptive text, and in 108 tables that occupy 34 pages.

William V. Turnage and T. D. Mallery. *An Analysis of Rainfall in the Sonoran Desert and Adjacent Territory.* Carnegie Institution of Washington Publication 529. 1941. 45 pp., illus.

The authors summarize some of the results of a study of rainfall data obtained at a considerable number of stations in the arid Southwest of the United States.

The periods of record range from 10 years or less for the seasonal rainfall stations which were maintained in unsettled localities by the Desert Laboratory of the Carnegie Institution, up to 50 years or more for some of the Weather Bureau stations.

There are two well-defined rainy seasons in the region, with essentially different types of precipitation. The rainfall of each season is discussed with reference to the effects of topographical relief, elevation, and slope exposure on the areal distribution. The variability over small areas is also investigated, and several other topics briefly touched.

It is concluded that "little essential advance can be made in the investigation of rainfall by continuation of readings at arbitrarily selected localities which happen to be centers of population. Intensive study of rainfall for a relatively short period at carefully selected critical localities would advance our knowledge far more than the continuation for many years of routine readings at sporadically located stations. Study of rainfall patterns in small areas and further study of topographic influences, in conjunction with investigation of run-off in relation to the incidence and intensity of rain, and of soil moisture in different types of soil, should go far toward meeting the

biological and agricultural needs in a field which is of basic importance in the North American Desert."

F. W. Sohon, S. J. *The Stereographic Projection.* Chemical Pub. Co., New York. 1941.

This book, by the Director of the Seismological Observatory, Georgetown University, Washington, D. C., is devoted to a very detailed and complete mathematical development of the theory, properties, and some of the applications of the stereographic projection, often by methods original with the author.

The stereographic projection, devised by the ancient Greeks, is perhaps the most generally all round useful of projections; and is important in many fields of applied mathematics in addition to cartography. The meteorologist is likely to encounter it not only among the synoptic maps with which he works but also in the course of his auxiliary studies in mathematics and physics.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR JUNE 1941

[Climate and Crop Weather Division, J. B. KINCER in charge]

AEROLOGICAL OBSERVATIONS

By EARL C. THOM

The mean surface temperatures for June were above normal over somewhat more than half of the country. Temperatures were above normal generally over the eastern half of the country and over parts of the extreme north and extreme west. The largest positive departure for the month, from 5° to 6° F. above normal, occurred in an area over the northern Great Lakes. Most of the western half of the country was somewhat below normal, a considerable area of the southern plateau region being from 2° to 3° lower than normal for the month.

At 1,500 meters above sea level the 5 a. m. resultant winds were from directions to the south of normal over most of the country. The opposite turning of the resultant winds from the normal at this level occurred at Medford, Oreg., over the extreme Northeastern States and over Oklahoma and eastern Texas. At 3,000 meters the morning resultant winds were from the south of normal over most of the country with the opposite turning occurring over New England and the upper Great Lakes as well as over a considerable part of the southern plateau and plains region. It was possible in the case of 17 stations to compare the direction of the 5 p. m. resultant winds for the month with the corresponding 5 a. m. normals. At 6 scattered stations the directions of the afternoon resultants were from directions somewhat more northerly than the corresponding morning resultants while the opposite shift was noted at this level for the other 11 stations.

The 5 a. m. resultant velocities for the 1,500 and 3,000 m. levels were below normal at most stations in that part of the northern two-thirds of the country which lies east of the Great Divide and were generally above normal at this level over the remainder of the country. At 5,000 meters the 5 p. m. resultant velocities were below the corresponding 5 a. m. normals over the northeast and north-central areas and were above the morning normals elsewhere.

The areas in which the 5 p. m. resultant winds at 1,500 meters were from directions to the south of the corresponding 5 a. m. winds, were not well defined and were about equal to the areas in which the opposite turning of the winds during the day occurred at this level. At 3,000 meters, however, most stations in the northern half and several stations in the south-central parts of the country had 5 p. m. resultant winds more southerly than the corresponding morning winds with the opposite shift occurring over most of the southern half of the country.

At more than half of the stations in the country the 5 p. m. resultant velocities were lower than the corresponding morning velocities at the 1,500 m. level. These p. m. velocities were higher than the a. m. velocities at this level, however, over parts of the extreme northwest, the extreme southwest and over portions of the North-Central and the Gulf States. At 3,000 meters the afternoon resultant velocities for the month were higher than the morning velocities over most of the eastern half of the country and over the southern plateau and plains region while the morning resultant velocities were higher than those of the afternoon generally over the rest of the country.

The upper air data discussed above are based on 5 a. m. (E. S. T.) pilot balloon observations (charts VIII and IX) as well as on observations made at 5 p. m. (table 2 and charts X and XI).

At radiosonde and airplane stations in the United States proper, the highest mean monthly pressure at each of the standard levels from 1,000 to 16,000 meters occurred over stations along the southern border of the country. At 1,500 meters the highest mean pressure occurred over Pensacola, Fla., at 3,000 meters over Miami, Fla., while at 14,000 meters and at each of the levels from 8,000 to 12,000 meters the corresponding minima occurred over Brownsville, Tex. At the other levels from 2,000 to 16,000 meters the same highest mean value for the level occurred at two or more southern stations. The lowest mean monthly pressure at 2,000 meters was recorded over Great Falls, Mont. At 3,000 meters the minimum mean pressure occurred over the three northwestern stations. The corresponding minima occurred over Seattle at 2,500 meters as well as at each of the standard levels from 4,000 to 12,000 meters. The same lowest mean pressure for 13,000 meters was observed over both Medford and Seattle while the lowest mean pressures for the 14,000, 15,000, and 16,000 meter levels were recorded over Medford.

With but few scattered exceptions, noted at the 1,000-, 2,000-, and 3,000-meter levels, June mean monthly pressures were higher than those for the previous month at all of the standard levels above the surface at all United States stations. This increase in mean pressure values over those of last month was especially well defined at the levels from 5,000 to 11,000 meters over the northeastern part of the country where it amounted to about 8 mb. In Alaska all reported pressures were higher than those of last month at all levels. (Data for Barrow and Bethel not available.)

The largest difference between the highest and lowest mean pressure values for stations in the United States proper was 18 mb. which occurred at the 8,000-, 9,000-, and 10,000-meter levels. Steep pressure gradients were noted on the pressure charts especially across the Northwestern States at the levels from 5,000 to 11,000 meters. The steepest gradient, a change of 1 mb. for each 67 miles of horizontal distance, between Seattle and Boise, occurred at each of the three levels, 8,000, 9,000, and 10,000 meters.

The mean temperatures for June were higher than those of the previous month at all levels above the surface up to and including 11,000 meters for all stations of the United States, while except at Oakland and San Diego mean surface temperatures were also higher than those for May. Temperatures at each of the levels above 12,000 meters